

Final Report for Period: 02/2007 - 07/2007**Submitted on:** 08/01/2007102538
1**Principal Investigator:** Muhanna, Rafi L.**Award ID:** 0607903**Organization:** GA Tech Res Corp - GIT**Title:**

Workshop on Modeling Errors and Uncertainty in Engineering Computations; Savannah, Georgia; February 22-24, 2006

Project Participants

Senior Personnel

Name: Muhanna, Rafi**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Dr. Muhanna is the PI of the project 'Workshop on Modeling Errors and Uncertainty in Engineering Computations' and served as the Chair of the workshop. He managed and organized all aspects of the workshop activities.

Name: Mullen, Robert**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Dr. Mullen is the Co-PI of the project 'Workshop on Modeling Errors and Uncertainty in Engineering Computations' and served as the Co-Chair of the workshop. He was involved in the management and organization of all aspects of the workshop activities.

Post-doc

Graduate Student

Undergraduate Student

Technician, Programmer

Other Participant

Research Experience for Undergraduates

Organizational Partners

Sun Microsystems

Sun Microsystems provided financial support to the workshop.

Other Collaborators or Contacts

Activities and Findings

Research and Education Activities:

The NSF workshop on Modeling Errors and Uncertainty in Engineering Computations was held during the period of February 22-24, 2006, at the Campus of Georgia Institute of Technology in Savannah, Georgia.

The workshop activity had focused on the promotion of cross-disciplinary research in the area of reliable engineering computing. The

workshop website can be found at: <http://www.gtsav.gatech.edu/workshop/rec06/index.html>

The scientific committee included 21 international leaders in engineering, science and mathematics, three honorary co-chairs (Raymond Moore, Eldon Hanson, and Ivo Babuška) in addition to the two co-chairs (Rafi Muhanna and Bob Mullen).

The Scientific committee was involved in carrying out the following tasks:

- ò Proposing participants
- ò Abstracts review
- ò Papers review

The members of the scientific committee are:

Götz Alefeld, Univ. of Karlsruhe, Germany
 Daniel Berleant, Iowa State University
 David Bogle, University College London
 George Corliss, Marquette University
 William Edmonson, North Carolina State University
 Michael Eldred, Sandia National Labs
 Scott Ferson, Applied Biomathematics
 Roger Ghanem, Univ. of Southern California
 Raphael Haftka, University of Florida
 Baker Kearfott, Univ. of Louisiana at Lafayette
 Vladik Kreinovich, University of Texas at El Paso
 Bernd Müller, Dresden Univ. of Technology
 Zissimos Mourelatos, Oakland University
 Arnold Neumaier, University of Vienna, Austria
 Efstratios Nikolaidis, University of Toledo
 Andrezej Pownuk, Silesian Univ. of Technology
 Sigfried Rump, Technical Univ. of Hamburg
 Pol Spanos, Rice University
 Mark Stadtherr, University of Notre Dame
 William Walster, Sun Microsystems
 Steve Wojtkiewicz, University of Minnesota

and can be found at: <http://www.gtsav.gatech.edu/workshop/rec06/committees.html>.

The workshop was able to attract 60 participants from all around the world. Participants were from various engineering fields, mathematics and computer science, as well as from biology. Special fellowships were established to encourage the participation of students. An overall of 36 speakers presented their works over the three-day period of the workshop, all presentations can be found at:

<http://www.gtsav.gatech.edu/workshop/rec06/proceedings.html>.

The presentations had covered the following main topics:

1. Errors in algorithms and computations.
2. Mitigation of various sources of errors in engineering calculations.
3. Integrating the treatment of modeling errors and uncertainty into design.

Proceedings of 484 pages and 29 papers were published and distributed in hard copies to the participants at the beginning of the workshop. The proceedings are posted on the workshop web site at: <http://www.gtsav.gatech.edu/workshop/rec06/index.html>.

Findings:

While some aspects of Modeling Errors and Uncertainty in Engineering Computations are included in conferences on general numerical methods, computer science, and engineering, they are addressed only by small subsets of researchers. This workshop was unique in giving the opportunity for a large group of researchers from various engineering fields, mathematics, and computer science to get together and exchange latest developments/discuss ideas on reliable engineering computing for the enhancement of analysis and design.

The success of such gathering (participants credentials, presentations and papers quality, active participation) has proven that there is a need for

researches in this area to have a common forum to share problems and progresses across the board to improve our understanding of Reliable Engineering Computing.

In addition, the workshop identified the need for integration of intrinsic errors (i.e. discretization errors) with external parameter uncertainties in engineering calculations. This is a shift in concept from treating uncertainty in input parameters, to an outcome based approach.

The recommendations came from the Workshops:

The workshop identified various methods for addressing discretization errors. Several model problems were identified for researchers to compare performance of methods on a common problem set. The need to integrate discretization errors with other sources of errors in engineering analysis was a common theme at the workshop. The future goal in integrating analysis errors into engineering design decisions was discussed.

The Math/Science participants emphasized the need to attract more engineers to this kind of meeting. Concomitantly, the engineering participants emphasized the need to attract more mathematicians and scientists. These observations demonstrate the need for enhancing the opportunities for interdisciplinary collaboration.

Training and Development:

The workshop raised the awareness of a number of the participants of the importance of modeling errors and uncertainty in engineering computations and how they affect the reliability of engineering computations in analysis and design. Specifically, graduate students and young researchers were exposed to the opportunities of developing new methods in reliable engineering computing.

Outreach Activities:

All the workshop activities were posted on the workshop's website.

Journal Publications

Books or Other One-time Publications

Rafi L. Muhanna and Robert L. Mullen, "Proceedings of the NSF workshop on Reliable Engineering Computing-Modeling Errors and Uncertainty in Engineering Computations", (2006). Book, Published

Editor(s): Rafi L. Muhanna and Robert L. Mullen

Collection: Proceedings of the NSF Workshop on Reliable Engineering Computing

Bibliography: February 22-24, 2006, Savannah, Georgia, USA

Web/Internet Site

URL(s):

<http://www.gtsav.gatech.edu/workshop/rec06/index.html>

Description:

This website is the official website of the workshop.

Other Specific Products

Contributions

Contributions within Discipline:

All papers that have been included in the workshop proceedings provided significant new development to the existing state of reliable engineering computing.

Contributions to Other Disciplines:

The publications are multidisciplinary.

Contributions to Human Resource Development:

The workshop represented a forum for participants to discuss, interact, and exchange knowledge on modeling errors and uncertainty in engineering computations, as well as to discuss the means for to achieve reliable computations in analysis and design. Participation of graduate students and young researchers provided them with the opportunities to learn the state-of-the-art in reliable engineering computing.

Contributions to Resources for Research and Education:

The workshop was able to form an international forum of experts in the area of reliable engineering computing who is interested to sustain research and development in this field.

Also the workshop produced a valuable information resources that have been made accessible to all.

Contributions Beyond Science and Engineering:

Reliable and dependable analysis and design are crucial for the health and safety of the U.S. population. More reliable structural systems will contribute into the reduction of life threatening failures and disasters. The ability to construct robust and dependable computing systems will aid the continuing economic development of the United States. The results of this workshop will contribute to the enhancement of the infrastructure for research and education in the US.

Categories for which nothing is reported:

Any Journal

Any Product